REMARKS

Claims 54-92 are pending. Claims 56, 57 and 83 through 85 are withdrawn from consideration. Claim 55 is allowed. By this Response, claims 70-74 are amended. Reconsideration and allowance based on the above on the above amendments and following remarks are respectfully requested.

§112, First Paragraph

The office Action rejects claim 63 under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement. Specifically, the Office Action alleges that "the phrase 'the layers are grown in a chemical vapor deposition (CVD) growth system' is not supported by the disclosure."

Applicants note that the contents of claim 63 are as originally filed with the application. MPEP §608.01 (L) states "in establishing a disclosure, applicant may rely not only on the description and drawings as filed but also on the original claims if their content justifies it." Applicants respectfully submit that the original claims are a part of the disclosure and the rejection for failure to comply with the written description requirement is improper.

Further, at least on page 12, lines 10-12, support is provided in the specification for growth and deposition processes. The specification does not reference all types of deposition and growth processes specifically, but refers generally to deposition and growth processes and therefore encapsulates the chemical vapor deposition growth system recited in claim 63.

Therefore, applicants respectfully submit that applicants' claimed features are in compliance with the written description requirement. Accordingly, withdrawal of the rejection is respectfully requested.

§112 Second Paragraph

The Office Action rejects claims 70 and 72 under 35 U.S.C. §112, second paragraph as being indefinite. Specifically, the Office Action states that the limitation "the substrate" is lacking sufficient antecedent basis. In response, applicants have amended claims 70 and 72 to address the antecedent basis issue. Accordingly, withdrawal of the rejection is respectfully requested.

Prior Art Rejections

Claim 54

The Office Action rejects claims 54, 58-60 and 62-63 under 35 U.S.C. §102(b) as being anticipated by Sweeny et al. ("Resonant Interband Tunnel Diodes", Appl. Phys. Lett., pp. 54-58, 1989) and claims 64-66, 69 and 89 through 92 as being unpatentable over Sweeny in view of Larson *et al.* (Diffusion of Sb in relaxed SiGe, pp. 2684-2686, Appl. Phys. Lett. 68 (19), 5 May 1996). These rejections are respectfully traversed.

Sweeny teaches tunnel diodes having n-type and p-type materials including a tunnel barrier layer positioned between the n-type quantum well and p-type quantum layer. Although Sweeny illustrates a fabricated tunnel diode, Sweeny does not teach or suggest the methods of fabricating an interband tunnel diode as recited in applicants' independent claim 54.

To properly reject claim 54, the method steps recited in the claim must be taught in the applied reference. Sweeny does not teach the method steps of creating the tunnel diode taught by Sweeny. Sweeny merely discusses a theoretical application of a particular tunnel diode having p-type and n-type quantum wells with the tunnel barrier layer positioned there between. Sweeny does not teach the fabrication methods of creating such tunnel diode.

Furthermore, elements of the claim are clearly absent in the teachings of Sweeny. Specifically, claim 54 recites "layering a top injector adjacent to the bottom injector, such that the top injector is separated by an offset from the bottom injector."

Sweeny does not teach the method step of layering a top injector adjacent to the bottom injector in such a manner that the top injector is separated by an offset from the bottom injector. In fact, the Examiner has not even addressed this claimed feature in the Office Action. Thus, if the Examiner wishes to maintain this line of rejection, applicants respectfully request the Examiner address all the claimed elements recited in claim 54.

In view of the above, applicants respectfully submit that Sweeny fails to teach each and every feature of independent claim 54 as required. Further, Larson fails to make up for the deficiencies of Sweeny. As Larson is provided to teach features found in the dependent claims and not independent claim 54. Accordingly, reconsideration and withdrawal of the rejections with respect to claim 54 and dependent claims 58 through 60, 62, 66, 69 and 89-92, are respectfully requested.

Claim 71

The Office Action rejects claim 71, and 86-88 under 35 U.S.C. §102(b) as being anticipated by Gennser, et al. (Resonant Tunneling of Holes Through Silicon Barriers, pp. 210-213, J.Vac.Sci. Tech. B 8 (2), 1990. This rejection is respectfully traversed.

Claim 71 recites a method of fabricating an interband tunnel diode comprising the step of lowering the substrate temperature before or during growth of each of the layers of interband tunnel diodes. Applicants respectfully submit that Gennser fails to teach this features of claim 71.

Gennser relates to intraband resonating tunneling of holes through silicon barriers in the valence band only after strain engineering the barrier height by a thick relaxed buffer layer. Gennser describes molecular-beam epitaxy grown Si/SiGe hole resonant tunneling devices consisting of an unstrained SiGe quantum well between two strained Si barriers. Gennser describes an undoped tunneling structure consisting of a quantum well surrounded by barriers and spacer layers of varying thicknesses grown at 390°C. As shown in Fig. 1(a) of Gennser, the quantum wheels are located in the valence band. Two light hole states and four heavy hole states exist in the quantum well. At most, Gennser describes intraband diode tunneling. Gennser does not disclose a method of fabricating an interband tunnel diode.

Claim 74 refers to fabricating an interband tunnel diode. Interband tunnel diodes and an intraband tunnel diode are significantly distinct in their operations and thus their fabricating techniques would be different. Therefore, relying upon Gennser to teach the fabrication of an interband tunnel as recited in claim 71 is improper.

Further, Gennser does not teach the step of lowering the substrate temperature before or during growth of each of the layers in the interband tunnel diode.

As taught in Gennser in the section titled "II. Experiment and Discussions", a first layer is grown at 425°C. An undoped tunneling structure is then grown at 390°C. The undoped tunnel structure includes multiple layers, i.e., a well surrounded by a barrier and spacer layer. As stated on line 19 of the first paragraph of this section, "the different quantum well layers and the spacer layers are clearly distinguished from each other."

Thus, the barrier and spacer layers are distinctive layers around the quantum well. Therefore, each of the layers are grown at the same temperature. Therefore, the temperature is not lowered during or after each layer. The structure is then covered with a contact layer. Gennser does not state at what temperature the contact layer is performed. As Gennser is silent at what temperature the contact layer is grown, this alone precludes Gennser from teaching the lowering of the substrate temperature before or during growth of each of the layers.

In view of the above, applicants respectfully submit that Gennser fails to teach or suggest the features of independent claim 71. Dependent claims 86-88 are also distinguishable for the above reasons as well as for the additional features they recite. Accordingly, reconsideration and withdrawal of the rejection with respect to claim 71 and its dependent claims are respectfully requested.

Claim 74

The Office Action rejects claims 74-78 under 35 U.S.C. §102(e) as being anticipated by Brockaert (US 6,218,677) and claims 79-82 under 35 U.S.C. §103(a) as being unpatentable over Brockaert in view of Larson.

Claim 74 recites a method of fabricating an interband tunnel diode by heat treating, during or after growth of each of the layers of the interband tunnel diode.

Applicants respectfully submit that Brockaert fails to teach the features of claim 74. Brockaert teaches an intraband resonant tunneling diode and method of fabricating the tunneling diode. Broekaert teaches an intraband tunnel diode with large barriers in the conduction band using silicon dioxide or calcium fluoride with unipolar transport. The Office Action relies upon the method steps detailed in Broekaert that teaches to "transfer wafer 600 in an ultrahigh vacuum from the MBE growth chamber to an oxidation chamber and heat it to 700.degree. C. in an oxygen atmosphere for 30 minutes to oxidize the surface of silicon layer 608 and thereby form 1 nm thick oxide layer 610 while reducing the thickness of silicon layer 608 to 3 nm." Broekaert uses a prolonged heat treatment to oxidize and therefore convert the topmost silicon layer to silicon dioxide. An embodiment of the present invention encompassed in Claim 74, teaches a short anneal in an inert or reducing atmosphere to heal point defects without a concurrent outdiffusion of dopants, which would occur during a prolonged 30 minute heat treatment. Broekart does not teach an interband tunnel diode.In Brockaert, heat treating is not performed during or after growth of each of the layers. Brockaert teaches heat treating twice during the growth process. Brockaert teaches growing four different layers. In the first and last layers Brockaert is silent as to performing a heat treatment. As Brockaert is silent it cannot teach the

feature of heat treating during or after growth of each of the layers in the interband tunnel diode, as recited in claim 74.

Therefore, in view of the above, Brockaert fails to teach each and every feature of claim 74 as required. Also, Larson fails to make up for the deficiencies of Brockaert as Larson is provided to teach elements of the dependent claims. Larsen teaches a method to measure diffusion coefficients of dopants in a non-device test structure. Larsen uses temperatures that are too high (719 to 1028 C) and for too long of a time (20 min to 24 hr) to be suitable for the interband tunnel diode in Claim 74. Thus, applicants respectfully request reconsideration and withdrawal of the rejection with regard to claim 74 and dependent claims 75-82.

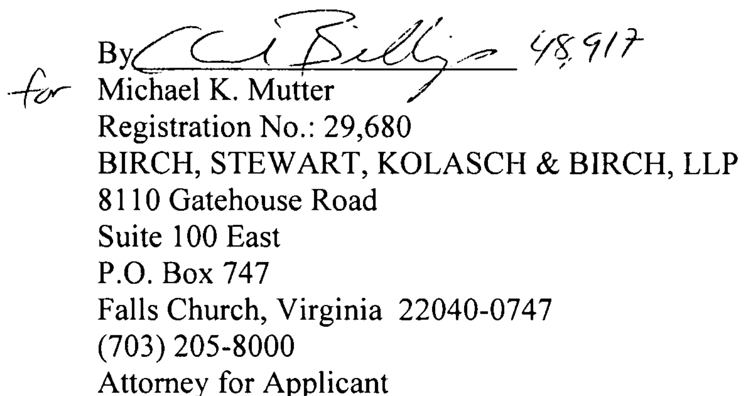
Conclusion

For at least the above reasons, it is respectfully submitted that claims 54-92 are distinguishable over the cited art. Favorable consideration and prompt allowance are earnestly solicited.

Dated:

MKM/CJB:cb

Respectfully submitted,



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